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## PROVISIONAL SPECIFICATION.

## Control Apparatus for Colour Lighting.

We, HOLOPHANE LIMITED, a company organised and existing under the laws of Great Britain and Ireland, and ROLLO GILLESPIE WILLIAMS, a British subject, all of Holophane House, Elverton Street, Vincent Square, London, S.W. 1, do hereby declare the nature of this invention to be as follows:—

This invention is a control apparatus for three or four colour lighting such as may be used for the stages and auditoriums of ordinary and cinematograph theatres, dance halls, shop windows and floodlighting, for example.

All desired pure coloured light may be made up by mixing three primary colours in different proportions. What are termed pastel shades are produced by admixing white light (which forms the fourth "colour" in four colour lighting) while it may also be desirable to be able to use white light alone. In theory there is an infinite number of different mixtures, but in practice it is found that about twelve pure colours obtained by admixing two primary colours only at a time in different proportions, together with three or four different proportions of white, provide an ample range. Hitherto it has been usual to control all four colours separately, this involving four separate dimmers for each lighting unit. A stage for example may be provided with say six units so that there are twenty four separate controls. Theoretically an infinite control is possible with this arrangement, but in practice it is found impossible to make use of even twelve different colours with the corresponding pastel shades and pure white as suggested above, and it is impossible with an ordinary control board to effect presetting.

According to the present invention each unit is provided with a step controller which at each step sets up the circuit for one of the desired colours by switching in the lamps of the appropriate primary colours and appropriate resistances, and with a dimmer resistance controlling the whole current taken by the unit. Where white light is also provided we may provide further steps on the controller for the desired pastel shades and white light

[Price 1/-]

alone, but we prefer to use a separate controller with say three or four steps, for white light. We prefer, further, to duplicate the controls of each unit whereby presetting can be effected as explained below. In either case we also prefer to provide each dimmer with a short circuiting switch and a break switch.

The currents to be controlled are too heavy for the control member itself to be the switch therefor and accordingly electrically operated remote contactors are used. The step controller may be of any kind, say a lever working in a slot but a convenient form is a hand wheel which may cover its range over any part of the circle, preferably in half or less. It is provided with a pointer working over a dial on which are marked the various colours set up and any other desired particulars. If desired the wheel may be continuously rotatable and effect the same sequence, one, two or three times per revolution, one two or three pointers being provided accordingly.

Considering one lighting unit only each colour circuit may be provided with the desired number of fixed resistances, say two arranged in parallel so that by closing the appropriate contactor the resistance is cut right out, or a small resistance included or a large resistance. The whole supply to the unit passes through a single dimming resistance controlled say by a wheel or lever, so that this resistance controls the whole unit.

Where white light is provided, preferably an auxiliary control member, conveniently a small wheel and pointer concentric with the main wheel is provided controlling three or four steps of fixed resistance through contactors, the whole current being supplied through the main dimmer. Both controls have an off position. Or there may be an off position at both ends of the dial. In practice a sufficient colour range can be provided by one strength of blue and three strengths each of red and green, this requiring seven contactors if both the colours and the resistances are contactor controlled. As an alternative, the colours only can be contactor controlled, requiring three

contactors, and the resistances directly controlled by a switch arm on the control itself arranged so that the circuits are made and broken at the contactors and not at the resistance studs. The order of colours on the dial may start with pure blue and pass through red admixtures to pure red, thence through green admixtures to green, thence through blue admixtures back to blue so that there is a blue position at each end of the dial. It is to be understood that the invention is in no way limited to any particular order or number of colours and that three fold colour mixtures may be employed as well as two fold. It is simply a question of arranging the contactor circuits and where necessary the resistance steps to be closed by the control, in the desired number and order.

The dimmer control is arranged so that at one end position the resistance is cut right out and at the other the circuit is broken and conveniently comprises a lever working in a slot.

The control members for each unit are mounted as usual on a control board and it will be seen that the proportions of colour are controlled by two members in place of four and that the control of the total power to each unit is controlled by a single control independently of the colour control.

Where there are several units, a master control is desirable. This may be effected by carrying the lines from each contactor to a barrel switch by which they may be connected either to the master controller or to their own control wheel. This barrel switch can deal with both the coloured and the white light contactors. The dimmers may be arranged side by side in the usual way and have their control arms separately clutchable to a common shaft leading to the master control. It will be observed that any number of units may be master controlled leaving others to be independently controlled.

To enable presetting to be effected the whole control gear for each unit is duplicated. There will thus be two colour control wheels, two white light control wheels and two dimmers. The two sets of circuits are wired in parallel. Thus when one control is in use and the second dimmer at the off position the second control can be preset and a dissolving change made by moving the first dimmer off and the second dimmer on. Where it is desired

to make sudden changes each dimmer may be provided with a short circuiting and a break switch which may be operated by a common handle. Further the duplicate controls may be arranged for separate connection to a duplicated master control as described above for the single control. It will be understood that in making a series of changes, the controls are used alternately.

Conveniently the controls for each unit are mounted on panels arranged side by side. The two concentric colour and white light controls are mounted in the upper half of the panel, one above the other, with the barrel switch handles for switching over to a master control beside them, while the dimmers are correspondingly arranged one above the other in the lower half of the panel with the short circuit and break switches beside them. The master controls may be arranged at the centre or end of the set of panels.

When duplicated the complete control system may be automatically operated from an electric motor or the like to give a repeating sequence of changes. For this purpose the colour and/or white light controls may be continuously rotatable. They are geared to be rotated slowly either steadily or step by step as by a Maltese cross mechanism, while the two dimmers (or short circuiting and break switches) are alternately moved on and off during the periods the colour and white controls are passing from one position to the next, as by a crank or cam mechanism. If the two colour and white controls are in step the sequence will be the same as that on the dials but by providing a free wheel device in the drives to either or both pairs of colour and white controls one may be stepped on by hand one or more steps with respect to the other and the successive steps of the sequence will be a corresponding number of dial steps apart. Moreover where there are several units, the different units may be put into or out of step with respect to one another.

Though not so useful, motor drive can also be employed where the controls are not duplicated.

Dated this 9th day of February, 1932.

SEFTON-JONES, O'DELL &  
STEPHENS,

Chartered Patent Agents.  
285, High Holborn, London, W.C. 1,  
Agents for the Applicants.

#### COMPLETE SPECIFICATION.

#### Control Apparatus for Colour Lighting.

We, HOLOPHANE LIMITED, a company organised and existing under the laws of

Great Britain and Ireland, and ROLLO GILLESPIE WILLIAMS, a British subject, 115

all of Holophane House, Elverton Street, Vincent Square, London, S.W. 1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention is a control apparatus for three or four colour lighting such as may be used for the stages and auditoriums of ordinary and cinematograph theatres, dance halls, shop windows and floodlighting for example.

All desired pure coloured light may be made up by mixing three primary colours in different proportions. What are termed pastel shades are produced by admixing white light (which forms the fourth "colour" in four colour lighting) while it may also be desirable to be able to use white light alone. In theory there is an infinite number of different mixtures, but in practice it is found that about twelve pure colours obtained by mixing two primary colours only at a time in different proportions, together with three or four different proportions of white, provide an ample range. Hitherto it has been usual to control all four colours separately, this involving four separate dimmers for each lighting-unit. By the term "unit" we mean any assemblage of lamps adapted to give all three or four colours each colour group being controlled as a whole; for example a footlight or batten light. A stage for example may be provided with say six units so that there are twenty four separate controls. Theoretically an infinite control is possible with this arrangement, but in practice it is found impossible to make use of even twelve different colours with the corresponding pastel shades and pure white as suggested above, and it is impossible with an ordinary control board to effect presetting.

According to the present invention each unit is provided with a step controller which at each step sets up the circuit for one of the desired resultant colours by switching in the lamps of the appropriate primary colours, and appropriate resistances, and with a dimmer resistance controlling the whole current taken by the unit. Where white light is also provided we may provide further steps on the controller for the desired pastel shades and white light alone, but we prefer to use a separate controller with say three or four steps, for white light. We prefer, further, to duplicate the controls of each unit whereby presetting can be effected as explained below. In either case we also prefer to provide each dimmer with a short circuiting switch and a break

switch.

The invention will be further described with reference to the accompanying drawings in which Figure 1 is a front view of a complete control board including a master control, for four units. Figure 2 is a circuit diagram for part of a single panel of the board shown in Figure 1, and Figure 3 is an alternative circuit diagram. In Figures 2 and 3, for the sake of simplicity only one pole of the wiring is shown.

When the currents to be controlled are too heavy for the control member itself to be the switch therefor, electrically operated remote contactors can be used. The step controller may be of any kind, say a lever working in a slot but a convenient form is a handwheel 1 which may cover its range over any part of the circle, preferably in half or less. It is provided with a pointer 2 working over a dial 3 on which may be marked the various colours set up and say other desired particulars. If desired the wheel may be continuously rotatable and effect the same sequence, one, two or three times per revolution, one two or three pointers being provided accordingly.

Considering one lighting unit only each colour circuit may be provided with the desired number of fixed resistances, say two arranged in parallel so that by closing the appropriate contactor the resistance is cut right out, or a small resistance included or a large resistance. The whole supply to the unit passes through a single dimmer resistance 16 controlled say by a wheel or lever so that this resistance controls the whole unit. It is to be understood that the dimmer may comprise a number of resistances in parallel say one for each colour which are controlled simultaneously, where the currents involved or other circumstances render this desirable.

Where white light is provided, preferably an auxiliary control member, conveniently a small wheel 4 and pointer concentric with the main wheel 1, is provided controlling three or four steps of fixed resistance through contactors, the whole current being supplied through the main dimmer. In the illustrated example the large wheels have an off position at the right hand end, but there may be an off position at both ends of the dial; the same applies to the small wheels 4.

In practice a sufficient colour range can be provided by one strength of blue and three strengths each of red and green. As is indicated in Figure 2, where R indicates the red section of the unit, B the blue section and G the green section, this requires seven contactors if both the

colours and the resistances are contactor controlled. It will be seen that the three uppermost contactors 5, 6 and 7 respectively close the supply to R through no resistance, a low resistance 8, and a high resistance 9 respectively.

The next contactor 10 closes the supply to B through no resistance. The last three contactors 11, 12 and 13 respectively close the supply to G through no resistance, a low resistance 14 and a high resistance 15. All contactors are connected to one main lead (marked +) through a main dimming resistance 16. The main is also carried to the controller arm 29 while the contacts are connected as shown to the various contactor coils. The control shown gives thirteen colour positions and an off position at the extreme right hand end of the arm. The extreme left hand position gives pure blue and passes thence through red admixtures to pure red thence through green admixtures to pure green and thence through blue admixtures back to pure blue. The circuits are readily followed and need not be described in greater detail.

Alternatively as illustrated in Figure 3 the colours only can be contactor controlled, requiring three contactors, and the resistances directly controlled by the control arm. Here the colours R. B. G. are supplied each through a single contactor, marked 17, 18, 19 respectively. As in the illustrated example blue requires no resistance steps and its contactor is connected direct to the lead 20 from the dimmer 16, the lead also extending to the controller arm, but it will be understood that where desired, blue may also have resistance steps. The outer two rows of contacts 21, 22 are connected to the contactor coils while two further inner rows 23, 24 put large or small resistances into, or cut resistance out of, the supply from the lead 20 to the respective sections of the unit. The controller arm reaches the respective contacts before the respective coil circuit is closed and leaves them after the respective coil circuit is opened, so that the circuits are made and broken at the contactor contacts and not at the controller contacts. The control sequence in Figure 3 is exactly the same as in Figure 2 and will readily be followed without further description.

It is to be understood that the invention is in no way limited to any particular order or number of colours and that three-fold colour mixtures may be employed as well as two-fold. It is simply a question of arranging the contactor circuits and where necessary the resistance steps to be included by the control arm in the desired

number and order.

The control of the dimmer 16 is arranged so that at the uppermost position the resistance is cut right out and at the lowermost the circuit is broken. The dimmer control conveniently comprises a lever 28 working in a slot as indicated in Figure 1.

The controlling members for each unit are mounted as usual on a panel 30 and it will be seen that the proportions of colour are controlled by two members 1 and 4 in place of four and that the control of the total power and to each unit is controlled by a single control 28 independently of the colour control.

Where there are several units, a master control is desirable as shown in the centre panel 30m of Figure 1. This may be effected by carrying the lines from each contactor and with a control according to Figure 3 an additional line from the contacts 23, 24 to a barrel switch 25 by which they may be connected either to the master controller 1m or to their own control wheel 1. In the cases of control according to Figure 3, the contacts in rows 23, 24 will be connected for master control to the corresponding contacts of the master controller, which however has no resistance of its own. In these cases the control wheel 1 must be moved out of positions in which the resistances switched in and out through the contacts in the rows 23, 24 are short circuited. This barrel switch 25 can deal with both the coloured and the white light contactors though only the former are indicated in Figures 2 and 3, a master white control wheel 4m being provided. The dimmers may be arranged side by side in the usual way and have their control arms separately clutchable to a common shaft leading to the master dimmer 28m. It will be observed that any number of units may be master controlled leaving others to be independently controlled.

To enable presetting to be effected the whole control gear for each unit is duplicated as shown in Figures 1 and 2, the duplicated controllers being marked with the same reference letters as above, with the suffix *d*. There will thus be two colour control wheels 1 and 1*d*. The two sets of circuits are wired in parallel as indicated in Figure 2. Thus when one control is in use and the other dimmer at the off position the second control can be preset and a dissolving change made by moving the first dimmer off and the second dimmer on. Where it is desired to make sudden changes each dimmer may be provided with a short circuiting switch 26, 26*d* and a break switch 27, 27*d*. In this case change from the control in use to

the preset control not in use is effected by opening the break switch of the former and closing the dimmer short circuiting switch of the latter; then a sudden change from the first control to a full on condition of the second is made. If these switches each have three positions and are suitably arranged each pair may be operated by a common handle as shown in Figure 1. Thus in one position of the handle switch 26 is on and switch 27 is on, when full light is obtained for the particular setting of the control; in a second position switch 26 is off and 27 on when the control is switched in but the dimmer 28 can be used to control the total current; and in the third position switch 26 can be on or off and switch 27 is off, when the control is out of use. Alternatively a two way and off switch may be used in place of the two switches 26, 27. To keep these switches small, they may act through contactors as indicated in Figure 2. Further the duplicate controls may be arranged as indicated in Figure 1 for separate connection to a duplicated master control as described above for the single control. It will be understood that in making a series of changes, the controls are used alternately.

Conveniently panels 30 carrying the controls for each unit are arranged side by side as shown in Figure 1. The two concentric colour and white light controls 1, 4 and 1*d*, 4*d* are mounted in the upper half of the panel, one above the other, with the barrel switch handles 25, 25*d* for switching over to the master control beside them while the dimmer arms 28, 28*d* are correspondingly arranged one above the other in the lower half of the panel with the short circuit switches 26, 26*d* and break switches 27, 27*d* beside them. The master controls may be arranged as shown on a panel 30*m* in the centre or they may be at one end of the set of panels, the controls being arranged thereon exactly as on the other panels 30.

When duplicated the set of controls on one or more panels may be continuously operated from an electric motor or the like to give a repeating sequence of changes. For this purpose the colour and/or white light controls may be continuously rotatable. They are geared to be rotated slowly either steadily or step by step as by a Maltese cross mechanism, while the two dimmers on any one panel (or short circuiting and break switches) are alternately moved on and off during the periods the colour and white controls are passing from one position to the next, as by a crank or cam mechanism. If the colour and white controls on any one

panel are in step the sequence in the corresponding unit will be the same as that on the dials but by providing a free wheel device in the drives to either or both colour and white controls on the panel one may be stepped on by hand one or more steps with respect to the other end and the successive steps of the sequence will be a corresponding number of dial steps apart. Moreover where there are several units, the different units may be put into or out of step with respect to one another. Such mechanism may also act through the master controls.

Though not so useful, motor drive can also be employed where the controls are not duplicated.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Control apparatus for colour lighting, in which for each lighting unit there is provided a step controller which at each step sets up the circuits for one of the desired resultant colours by switching in the lamps of the appropriate primary colours and appropriate resistances, the whole current taken by the unit being controlled by a dimmer resistance.

2. Control apparatus according to claim 1 in which step control for white light in addition to the primary colours is provided, preferably in the form of a separate step controller.

3. Control apparatus according to claim 1 or 2 in which each dimmer is provided with a short circuiting switch and/or a break switch.

4. Control apparatus according to claim 1, 2 or 3 in which the dimmer control at one end position cuts out the resistance completely and at the other end position breaks the circuit.

5. Control apparatus according to any preceding claim in which the circuits carrying the currents to be controlled are made and broken by electrically operated remote contactors.

6. Control apparatus according to any preceding claim in which the circuits controlled by the step controllers can be electrically connected to a master control, and the dimmer resistance controls mechanically coupled to a master control.

7. Control apparatus according to any preceding claim in which each control device is duplicated and the duplicate controls arranged in parallel whereby pre-setting and change over can be effected.

8. Control apparatus according to any preceding claim provided with continuously operating means to give a repeating sequence of changes.

9. Control apparatus according to claim 1 constructed substantially as shown in Figure 1 and herein described.

10. Control apparatus for colour lighting units having its circuits arranged as shown in Figure 2 or Figure 3 and herein described.

Dated this 9th day of February, 1933.

SEFTON-JONES, O'DELL &  
STEPHENS,

Chartered Patent Agents,  
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Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1933

Fig.1.

[This Drawing is a full-size reproduction of the Original.]

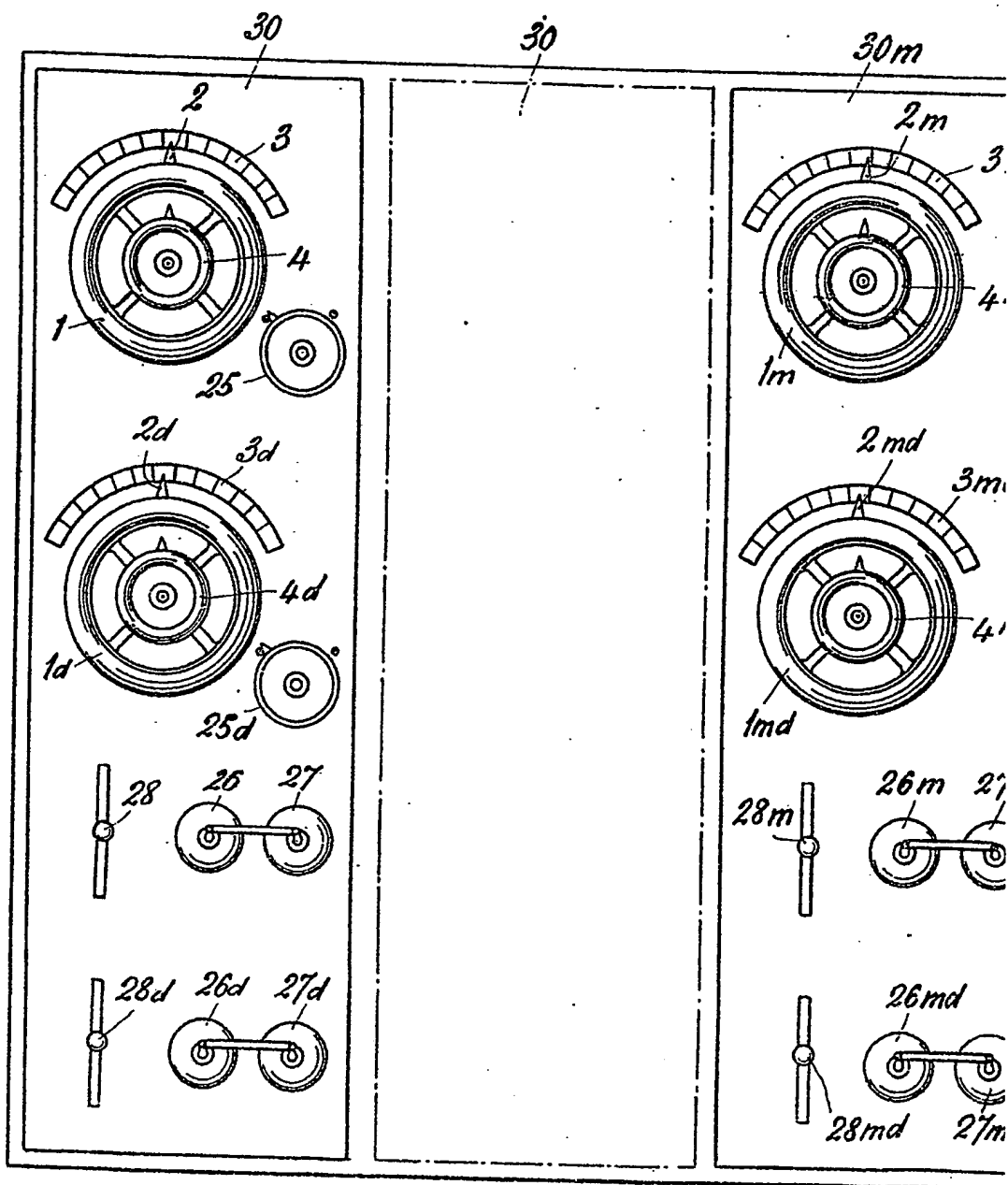


Fig. 1.

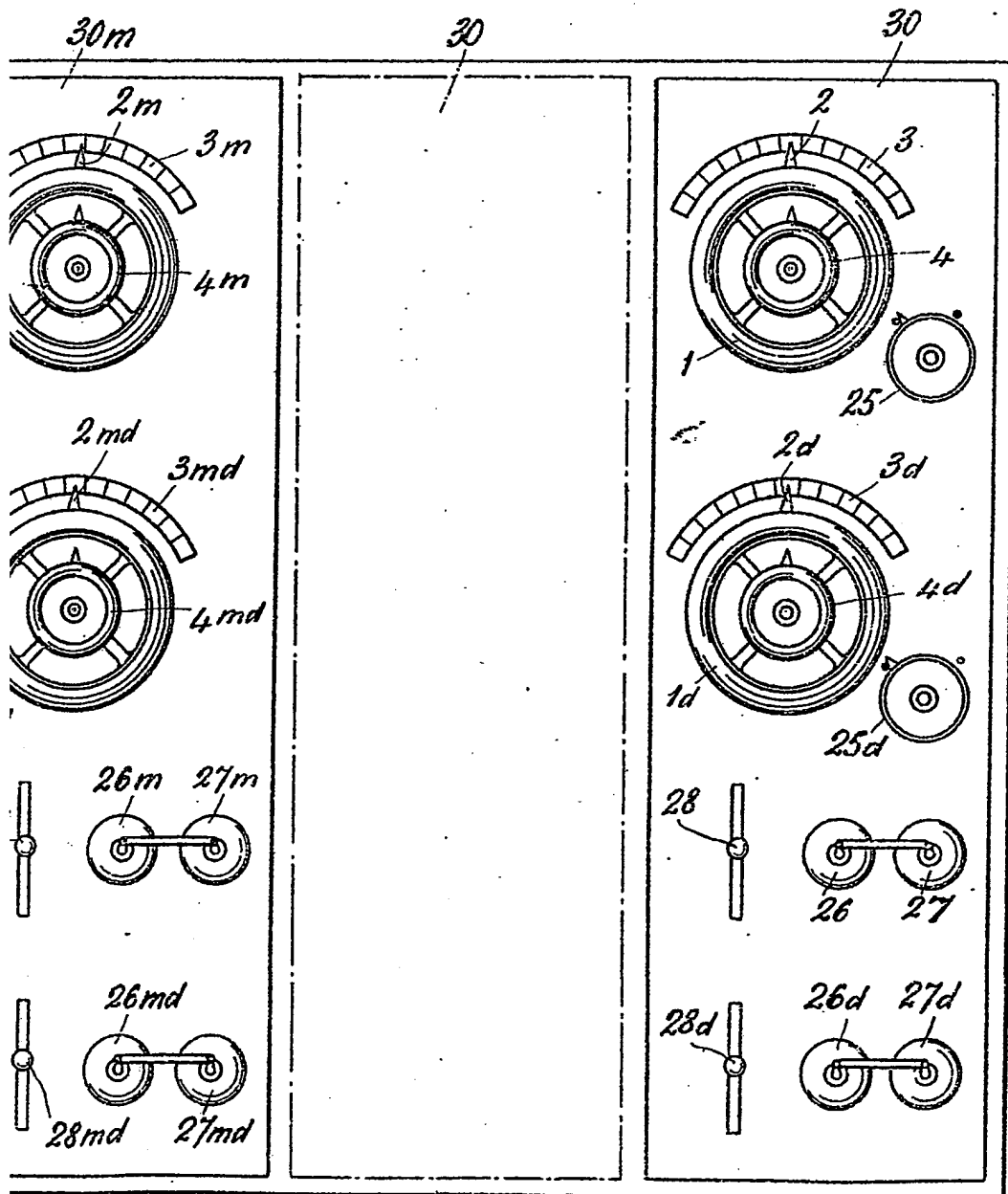
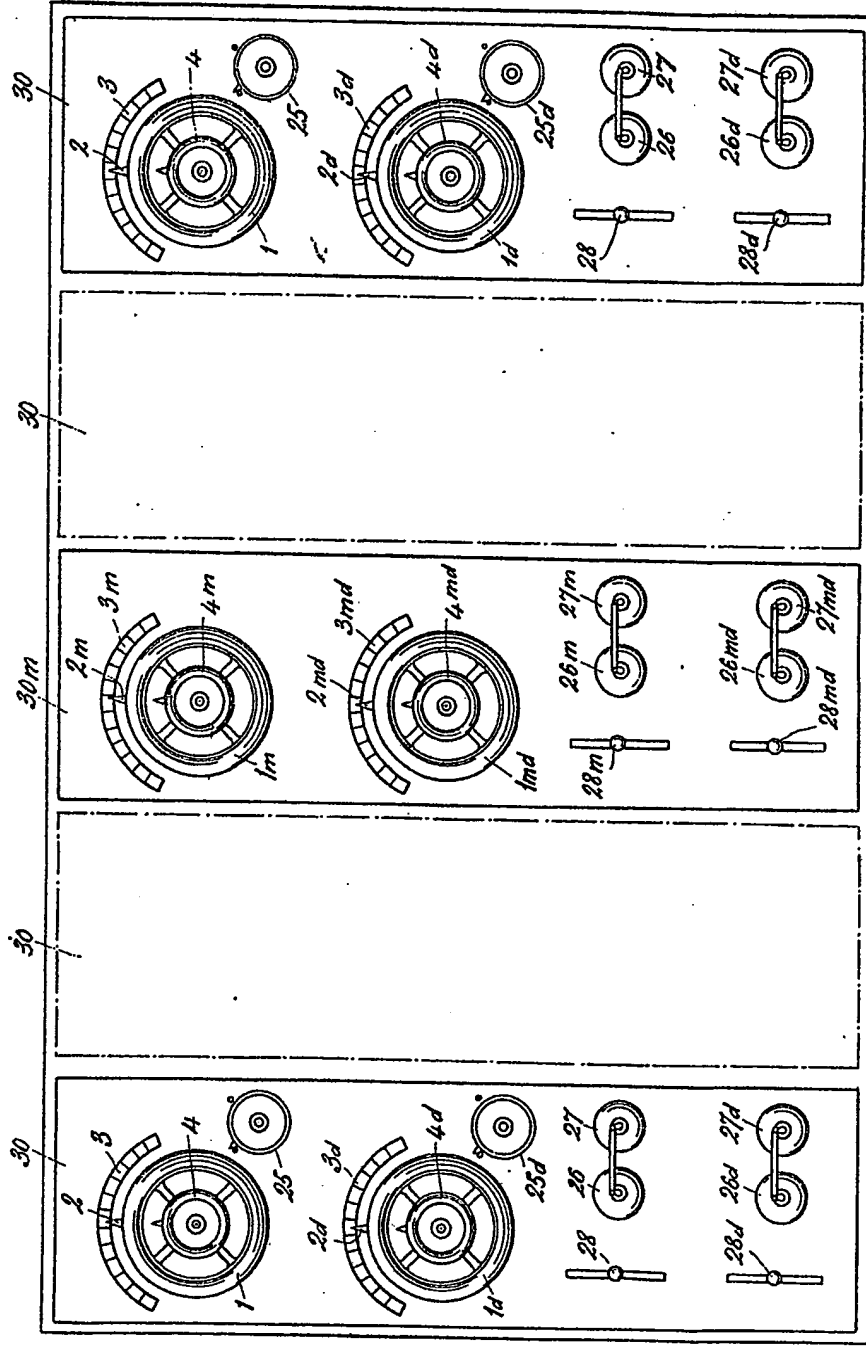




Fig. 1.



[This Drawing is a full-size reproduction of the Original.]

Fig. 2.

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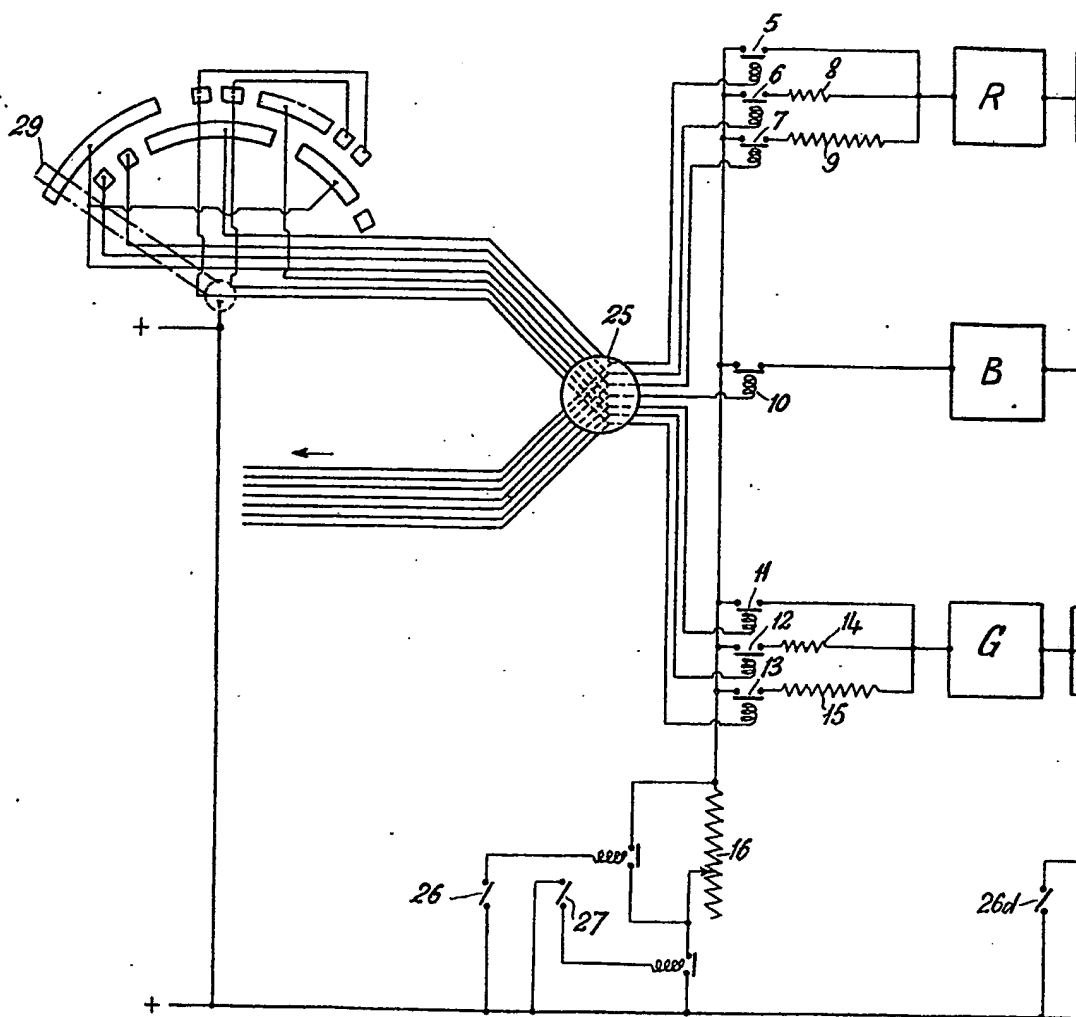


Fig. 2.

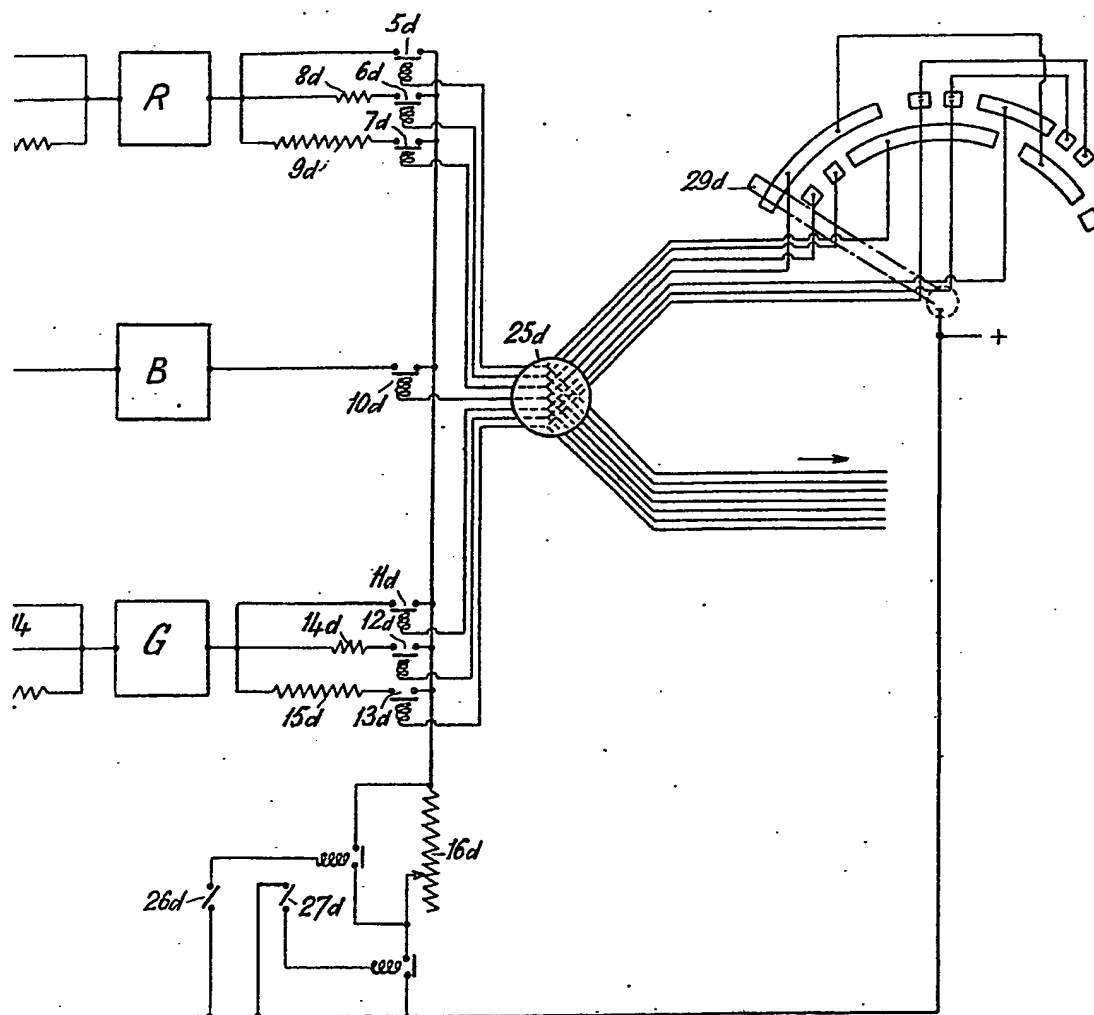
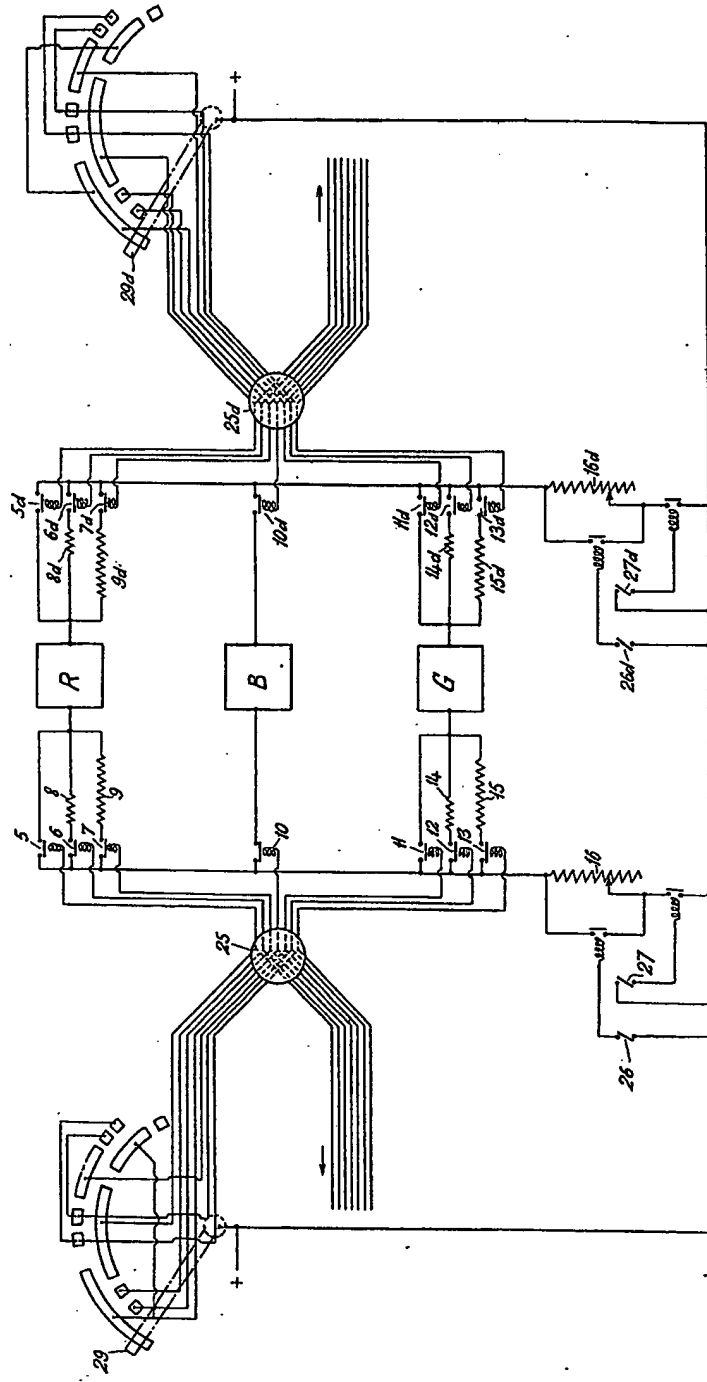


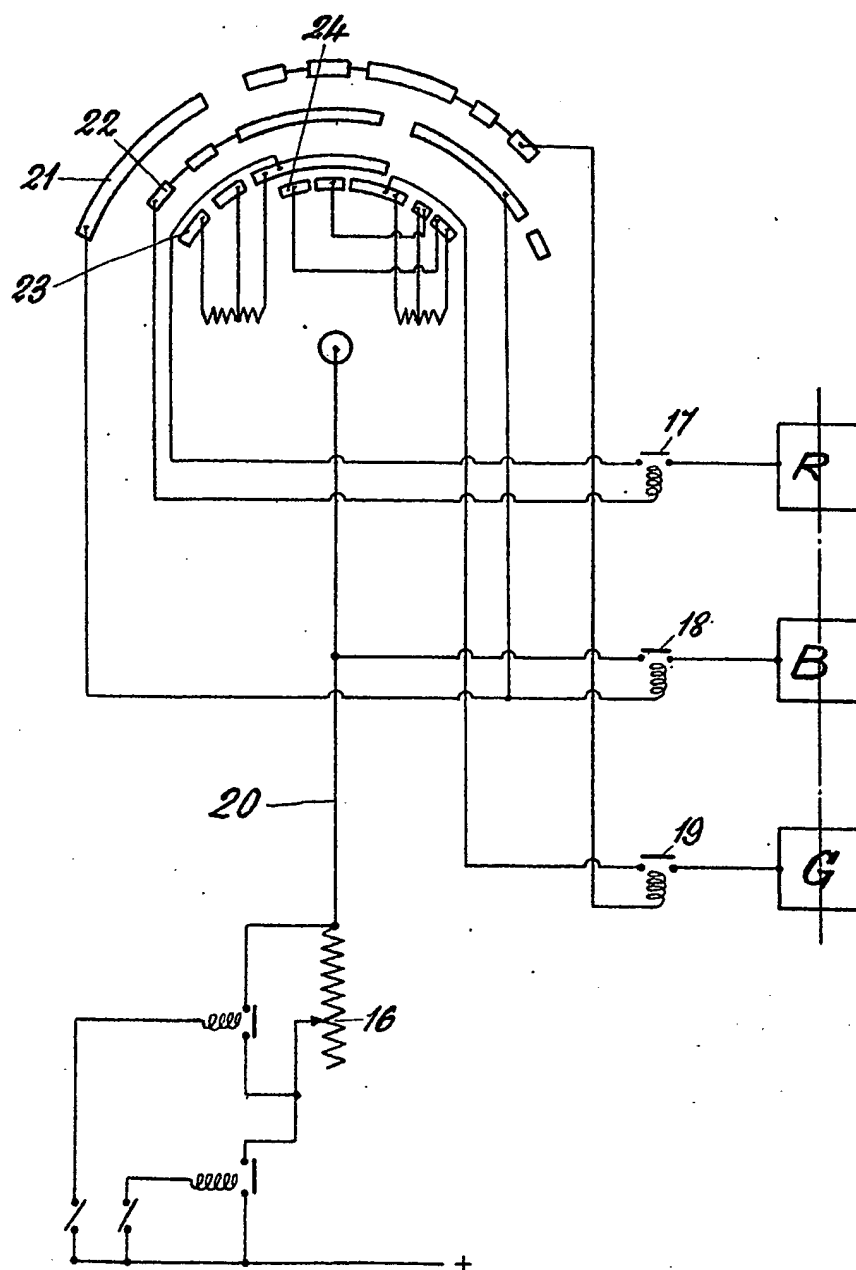
Fig. 2.



[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 3.

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